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APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
09/683,781	02/13/2002	Jianying Li	GEMS8081.117	9495

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EXAMINER

SONG, HOON K

ART UNIT	PAPER NUMBER
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2882

DATE MAILED: 07/14/2004

Please find below and/or attached an Office communication concerning this application or proceeding.

Office Action Summary	Application No.	Applicant(s)	
	09/683,781	LI ET AL.	
	Examiner	Art Unit	
	Hoon Song	2882	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE 3 MONTH(S) FROM THE MAILING DATE OF THIS COMMUNICATION.

- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If the period for reply specified above is less than thirty (30) days, a reply within the statutory minimum of thirty (30) days will be considered timely.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

- 1) ☒ Responsive to communication(s) filed on 26 April 2004.
- 2a) ☒ This action is **FINAL**. 2b) ☐ This action is non-final.
- 3) ☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

- 4) ☒ Claim(s) 1,2,4-8,12-16 and 19-26 is/are pending in the application.
- 4a) Of the above claim(s) _____ is/are withdrawn from consideration.
- 5) ☐ Claim(s) _____ is/are allowed.
- 6) ☒ Claim(s) 1,2,4-8,12-16 and 19-26 is/are rejected.
- 7) ☐ Claim(s) _____ is/are objected to.
- 8) ☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

- 9) ☐ The specification is objected to by the Examiner.
- 10) ☒ The drawing(s) filed on 13 February 2002 is/are: a) ☒ accepted or b) ☐ objected to by the Examiner.
Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).
Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).
- 11) ☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

- 12) ☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).
- a) ☐ All b) ☐ Some * c) ☐ None of:
1. ☐ Certified copies of the priority documents have been received.
2. ☐ Certified copies of the priority documents have been received in Application No. _____.
3. ☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).
- * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

- 1) ☒ Notice of References Cited (PTO-892)
- 2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)
- 3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
Paper No(s)/Mail Date _____
- 4) ☐ Interview Summary (PTO-413)
Paper No(s)/Mail Date _____
- 5) ☐ Notice of Informal Patent Application (PTO-152)
- 6) ☐ Other: _____

DETAILED ACTION

Claim Objections

Claims 2 and 4 are objected to because of the following informalities:

In claim 2 lines 1-2, "the second voltage" and "the first voltage" lack proper antecedent basis.

In claim 4 lines 4-5 and 5-6. "the first voltage" and "the second voltage" lack proper antecedent basis.

In claim 7 line 14, "the data acquisition stage" lacks proper antecedent basis.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

Claims 7-8 and 12-14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Regarding claim 7, on line 19, "the imaging data" lacks proper antecedent basis, and it is unclear whether "the imaging data" is data from the primary acquisition stage, the secondary acquisition stage or both of the primary acquisition stage and the secondary acquisition stage. The reconstructed image contains both data from the primary acquisition stage and the secondary acquisition stage?

Claim Rejections - 35 USC § 102

The following is a quotation of the appropriate paragraphs of 35 U.S.C. 102 that form the basis for the rejections under this section made in this Office action:

(e) the invention was described in (1) an application for patent, published under section 122(b), by another filed in the United States before the invention by the applicant for patent or (2) a patent granted on an application for patent by another filed in the United States before the invention by the applicant for patent, except that an international application filed under the treaty defined in section 351(a) shall have the effects for purposes of this subsection of an application filed in the United States only if the international application designated the United States and was published under Article 21(2) of such treaty in the English language.

Claims 1-2, 4-6, 15-16 and 19-26 are rejected under 35 U.S.C. 102(e) as being anticipated by Becker et al. (US 6560309B1).

Regarding claim 1, Becker teaches a method of voltage modulation for computed tomography (CT) imaging comprising the steps of (figure 3):

- acquiring a set of cardiac signals (ECG) having a plurality triggering pulses (R-R);
- determining a period of delay (D_R) after each triggering pulse (R);
- after each period of delay, energizing a high frequency electromagnetic energy source to a data acquisition voltage (R_I , D_I , column 5 lines 52-55);
- acquiring a set of imaging data of a scan subject (column 5 lines 52-55); and
- after acquiring the set of imaging data, energizing the high frequency electromagnetic energy source to a non-data acquisition voltage until the period of delay after a next triggering pulse (column 5 lines 22-25 and lines 45-47).

Regarding claim 2, Becker teaches that the second voltage is less than the first voltage (column 5 lines 22-25 and lines 45-47).

Regarding claim 4, Becker teaches that the step of (figure 3):

- determining a primary (high) and a secondary (low) imaging stage from the set of cardiac signals;

energizing the high frequency electromagnetic energy projection source to the first voltage (high) during the primary imaging stage; and

energizing the high frequency electromagnetic energy projection source to the second voltage (low) during the secondary imaging stage.

Regarding claim 5, Becker teaches that the step of filtering low energy high frequency electromagnetic energy projected to the scan subject to reduce high frequency electromagnetic energy exposure to the scan subject (low and high)

Regarding claim 6, Becker teaches that the step of determining a radiation dosage profile from the set of cardiac signals (x-ray dose control signal).

Regarding claim 7, Becker teaches a radiation emitting imaging system comprising

A high frequency electromagnetic energy projection source (1) configured to project high frequency energy toward a scan subject (8);

A detector assembly (2) to receive high frequency electromagnetic energy attenuated by the scan subject and output a plurality of electrical signals indicative of the attenuation to a data acquisition system;

A control configured to:

Determine a primary data acquisition stage (R_I , D_I) and a secondary data acquisition stage (D_p) for an R-R interval (T_{RR}) the primary data acquisition stage beginning after a triggering pulse and the secondary data acquisition stage occurring after the primary data acquisition stage and ending before a next triggering pulse of a next R-R interval (T_{RR}) (figure 3);

Energize the high frequency electromagnetic energy projection source to a first voltage (higher voltage) during the data acquisition stage to acquire primary imaging data;

Energize the high frequency electromagnetic energy projection source to a second voltage (1/5) different from the first voltage during the secondary data acquisition stage (column 5 line 42-48); and

Reconstruct an image of the scan subject (column 6 line 13-20)

Regarding claim 11, Becker teaches that the plurality of secondary data acquisition stages includes a plurality of non-data acquisition stages (unregistered)

Regarding claim 12, Becker teaches a plurality of EKG sensors (27) configured to acquire a set of EKG signals of a cardiac region of the scan subject (figure 3).

Regarding claim 13, Becker teaches that the control is further configured to determine a data acquisition stage (high) and a secondary acquisition (low) system from the set of EKG signals (figure 3, column 5 line 50-64).

Regarding claim 14, Becker teaches that the control is further comprised to determine a number of subsets from the set of EKG signals and determine a triggering pulse within each subset and energize the high frequency electromagnetic energy projection source to the first voltage after a delay of the triggering pulse (figure 3, column 5 line 50-67).

Regarding claim 15, Becker teaches a computer (31) readable storage medium having a computer program stored thereon and representing a set of instructions that when executed by a computer causes the computer to:

Analyze a set of cardiac motion signals acquired from a set of EKG sensors (27) from a torso region of a scan subject (8);

Determining from the set of cardiac motion signals a number of primary data acquisition stages (R_I , D_I) and a number of secondary acquisition stages (D_R), wherein each secondary acquisition stage follows primary data acquisition stage and wherein each primary data acquisition stage occurs entirely within a respective single R-R interval (figure 3);

Transmit a first voltage modulation signal to a voltage source configured to energize an x-ray projection source used to project x-rays to the scan subject for data acquisition, the first voltage modulation signal configured to energize the voltage source to a first voltage (high) for each primary data acquisition stage (see I_o, figure 3, column 6 line 13-20);

Acquire a set of imaging data (column 6 line 13-20); and

Transmit a second voltage modulation signal to the voltage source, the second voltage modulation signal being configured to energize the voltage source to second voltage (low tube current) for each secondary acquisition stage, the second voltage (low) being different than the first voltage (see I_o, figure 3).

Regarding claim 16, Becker teaches that the set of instructions further causes the computer to determine a dosage profile from the set of EKG signals and modulate the voltage source according to the dosage profile (x-ray dose control signal).

Regarding claim 19, Becker teaches that the set of instructions further causes the computer to reduce x-ray projections (low tube current) to the scan subject during the number of secondary acquisition stages (figure 3).

Regarding claim 20, Becker teaches that the set of instructions further causes the computer to determine the first voltage from a set of imaging parameters on a per imaging session basis (figure 3, the x-ray current is controlled per each imaging section of the R-R interval).

Regarding claim 21, Becker teaches that the number of secondary acquisition states includes a number of non-data acquisition stages (figure 3)

Regarding claim 22, Becker teaches a method of cardiac CT imaging comprising the steps of:

Acquiring a series of cardiac signals (EKG) defining a number of cardiac cycles each cardiac cycle defined by successive R pulses (R, figure 3);

Determining a primary acquisition period (RI, DI) that begins after a first R pulse of a cardiac cycle and a second acquisition period (D_p) that occurs after the primary acquisition period and begins before a second R pulse of the cardiac cycle for the number of cardiac cycles;

Energizing an x-ray source to a default, non-zero voltage (non-zero tube current, figure 3);

Initiating CT data acquisition for the number of cardiac cycles (figure 3);

Energizing the x-ray source to a primary voltage that exceeds the default, non-zero voltage during CT data acquisition for the primary acquisition periods (RI, DI, column 5 lines 52-55); and

Returning the x-ray source to the default, non-zero voltage during CT data acquisition for the secondary acquisition periods (figure 3, column 5 lines 22-25 and lines 45-47).

Regarding claim 23, Becker teaches the primary voltage includes a maximum voltage (figure 3).

Regarding claim 24, Becker teaches a radiation emitting imaging system comprising:

A high frequency electromagnetic energy projection source (1, x-ray source) configured to project high frequency energy toward a scan subject (8);

A detector assembly (2) to receive high frequency electromagnetic energy attenuated by the scan subject (8) and output a plurality of electrical signal indicative of the attenuation to a data acquisition system (31, column 3 line 63-67);

A control configured to:

Model data acquisition for a heart of the scan subject (8) based on a series of cardiac signals defining a number of cardiac cycles (EKG) of the heart, each cardiac cycle defined by a first R pulse and a second R pulse (L vs. t graph, figure 3);

Modulate voltage of the high frequency electromagnetic energy projection source (1) between a first voltage (figure 3) and a second voltage (figure 3) during each cardiac cycle (I vs. t graph, figure 3);

Acquire imaging data of the heart with the high frequency electromagnetic energy projection source at the first voltage (data acquisition) and the second voltage (non-data acquisition), the first voltages being different from the second voltage (since Becker's low voltage is not zero, the controller is acquiring any image data (noise, special frequency signal, detector noise etc., column 7 line 8-18); and

Reconstruct an image (with only data from RI, DI) of the scan subject for multiple phases of each cardiac cycle (column 6 line 13-20).

Regarding claim 25, Becker teaches that the first voltage includes a default voltage (non-zero voltage) and the second voltage includes a maximum voltage (high voltage).

Regarding claim 26, Becker teaches the default voltage includes a minimum voltage required to acquire data (non-zero voltage).

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all obviousness rejections set forth in this Office action:

(a) A patent may not be obtained though the invention is not identically disclosed or described as set forth in section 102 of this title, if the differences between the subject matter sought to be patented and the prior art are such that the subject matter as a whole would have been obvious at the time the invention was made to a person having ordinary skill in the art to which said subject matter pertains. Patentability shall not be negated by the manner in which the invention was made.

Claim 8 is rejected under 35 U.S.C. 103(a) as being unpatentable over Becker in view of Hampel et al. (US 6298117B1).

Regarding claim 8, Becker fails to teach a bowtie filter configured to filter a portion of the high frequency electromagnetic energy projected by the high frequency electromagnetic energy projection source to the scan subject.

Hampel teaches a CT scanner having a bowtie filter.

It would have been obvious to one of ordinary skill in the art at the time of the invention to provide the CT system of Becker with the bowtie filter as taught by Hampel, since the filter of Hampel would further reduce an x-ray dosage for the patient.

Response to Arguments

Applicant's arguments with respect to claims 1-2, 4-8, 12-16 and 19-26 have been considered but are moot in view of the new ground(s) of rejection.

Conclusion

Applicant's amendment necessitated the new ground(s) of rejection presented in this Office action. Accordingly, **THIS ACTION IS MADE FINAL**. See MPEP § 706.07(a). Applicant is reminded of the extension of time policy as set forth in 37 CFR 1.136(a).

A shortened statutory period for reply to this final action is set to expire **THREE MONTHS** from the mailing date of this action. In the event a first reply is filed within **TWO MONTHS** of the mailing date of this final action and the advisory action is not mailed until after the end of the **THREE-MONTH** shortened statutory period, then the shortened statutory period will expire on the date the advisory action is mailed, and any extension fee pursuant to 37 CFR 1.136(a) will be calculated from the mailing date of

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the advisory action. In no event, however, will the statutory period for reply expire later than SIX MONTHS from the date of this final action.

Any inquiry concerning this communication or earlier communications from the examiner should be directed to Hoon Song whose telephone number is (571) 272-2494. The examiner can normally be reached on 8:30 AM - 5 PM, Monday - Friday.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Edward Glick can be reached on (571) 272 - 2490. The fax phone number for the organization where this application or proceeding is assigned is 703-872-9306.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see <http://pair-direct.uspto.gov>. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).

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